POOR LEGIBILITY

ONE OR MORE PAGES IN THIS DOCUMENT ARE DIFFICULT TO READ DUE TO THE QUALITY OF THE ORIGINAL

Holly

Final Report was Dated April 26, 1980

FINAL REPORT

TECHNICAL ASSISTANCE PANEL

ASSESSMENT OF THE TRI-CITIES LANDFILL IN THE PHOENIX METROPOLITAN AREA

CONTRACT NO. 68-01-6009

WORK ASSIGNMENT NO. 80-1

upper/lower case

NC

Presented to

U. S. ENVIRONMENTAL PROTECTION AGENCY
REGION IX
San Francisco, California

compiled by

SCS ENGINEERS
4014 Long Beach Boulevard
Long Beach, California 90807
(213) 426-9544

under

April —,
~~March 20,~~ 1980

CONTENTS

SECTION 1

INTRODUCTION

BACKGROUND

The Tri-Cities solid waste landfill is located on the Salt River Indian Reservation east of Phoenix, Arizona. The landfill is an enterprise of the Pima Maricopa Indian community, and has been operated by the community since 1972.

Landfill operations have been adjacent to the Salt River watercourse since its inception. Gravel mining by Union Rock Company, under an agreement with the Indian community, has created pits into which municipal solid waste (MSW) is placed and compacted. Three suburban Phoenix cities, Scottsdale, Mesa, and Tempe, rely almost exclusively on this site for disposal of their MSW. ~~Although the bulk of the~~ Most waste received is ~~MSW, undefined~~ from residential and commercial sources. However, small amounts of septic tank pumpings and possibly industrial liquid wastes have been received periodically at the site.

During the winters of 1978-1979 and 1979-1980, the Phoenix area experienced unusually high rains and subsequent flooding of the Salt River. The floods of March 1979 and March 1980 breached the river channel and partially washed out in-place refuse adjacent to the river. Two separate areas were affected by washout. (5)[7]

The Arizona State Department of Health Services (ADOHS), Bureau of Sanitation, has expressed its concern over potential

environmental problems caused by past and future washouts, and potential contamination of ground and surface water due to flooding and/or ground water intrusion. By letter dated November 28, 1979, the Indian community requested technical assistance from the Environmental Protection Agency (EPA) to develop a plan for developing alternative solutions, if necessary.

PURPOSES OF INVESTIGATION

On December 6, 1979, the Technical Assistance Panel (TAP) contractor attended a meeting in Phoenix with representatives of the Indian community, the Indian Health Service (IHS), the ADOHS, the EPA, the Maricopa Association of Governments (MAG), and the State Attorney General's office to define the problem and to determine precisely what assistance was necessary.

As a result of this meeting, the TAP contractor was requested to provide technical assistance in the following subject areas related to the Tri-Cities landfill:

- Evaluation of overall site compatibility with respect to EPA sanitary landfill site location and operational criteria.
- Evaluation of potential environmental problems due to ~~possible unauthorized hazardous~~ waste disposal of such
- Determination of alternative methods for correcting any deficiencies noted.

Determination of the extent to which hazardous wastes have been placed in the site and

INSERT (A)

INSERT (A) to p. 2

~~INTRODUCTION/OVERVIEW~~

This report is the result of an EPA technical assistance panels investigation of practices and operations at the Tri-Cities sanitary landfill, located in the Phoenix metropolitan area. Appendix A lists the agencies and organizations ~~involved in~~ contributing to this technical assistance panel. Written reports were prepared by Ken Schmidt, consultant to MAG ~~Maricopa Association of Governments~~, and SCS Engineers, technical assistance panels (prime contractor to Region IX, EPA. On April 2, 1980, ~~the~~ A draft report prepared by SCS Engineers was reviewed by the panel. This final report incorporates comments by all parties and ~~is thus~~ reflects a concensus ~~document~~ of the panel.

Overall, the routine municipal solid waste disposal operations are acceptable, especially considering the relatively poor quality of the available soil for refuse covering and the site's location with respect to the river.

Several deficiencies were identified by the panel in relation to the EPA criteria for operation of solid waste disposal facilities. Most ~~of these~~ deficiencies ~~were related to~~ are due to the site's location and are explained in this report.

SECTION 2

LANDFILL DESCRIPTION

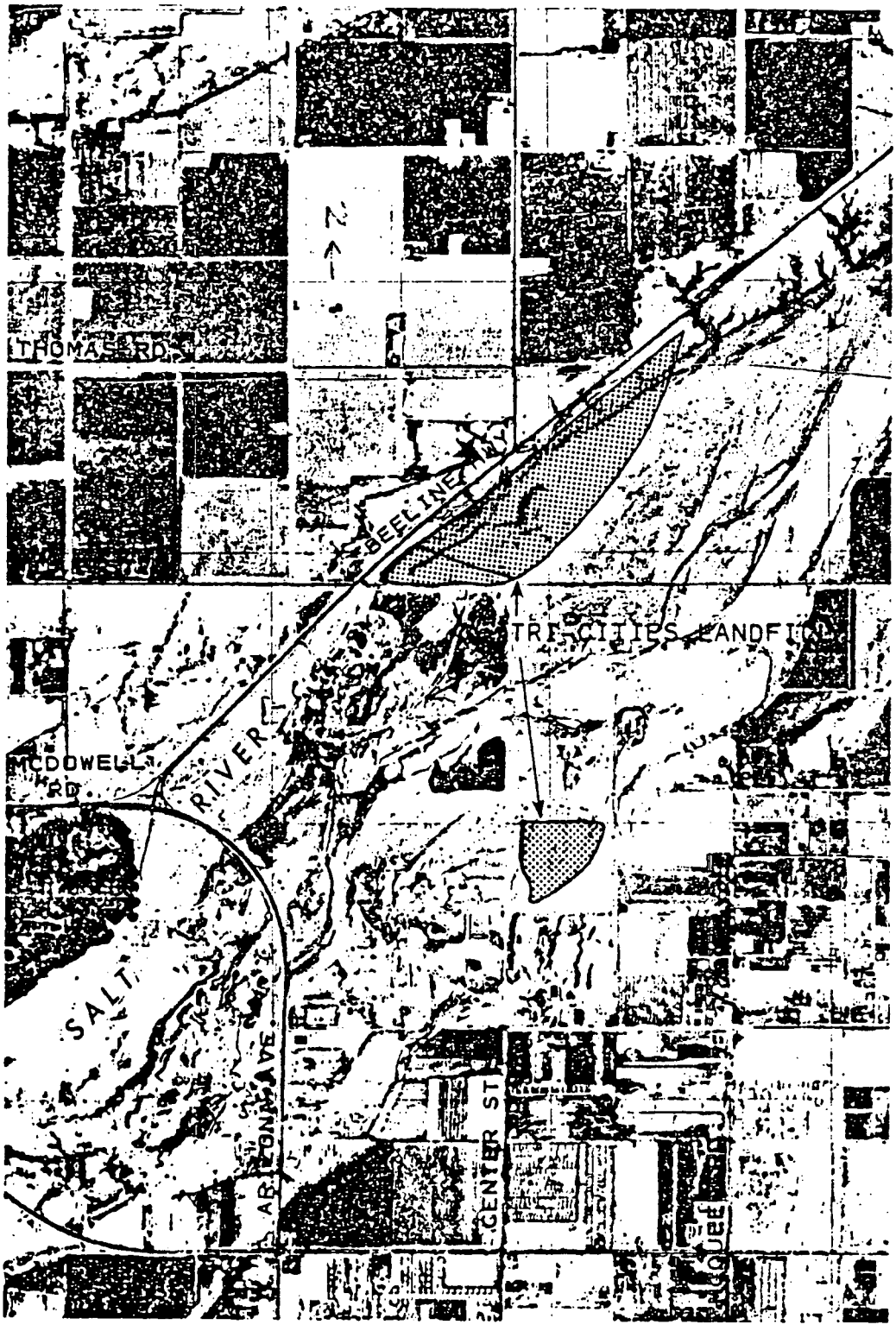
GENERAL DESCRIPTION

The Tri-Cities landfill is located about 15 miles east of downtown Phoenix on Beeline Highway between McDowell Road and Thomas Street (Figure 1).

Immediately surrounding the landfill are extensive agricultural areas used primarily for the production of cotton. Union Rock Company holds a production lease in the Salt River channel directly adjacent to and southwest of the Tri-Cities landfill. The rock company is currently producing construction aggregate materials from a quarrying and crushing operation, and also operates an asphalt "hot plant" and a cement mixing "batch plant" on the property.

The vicinity near the landfill is generally unurbanized; only a very modest degree of industrial, commercial, or residential development is apparent.

Climate in the area is semiarid. Annual normal rainfall is about 7.2 inches, occurring mostly in the winter and spring months. Average temperatures in the summer and winter months are in the low 100's ^{o}F and high 60's ^{o}F, respectively. Relative humidity ranges from as low as 18 percent in the summer to as high as 68 percent in the winter.



Fugure 1. Location of Tri-Cities landfill.

GEOLOGY AND HYDROLOGY

General Geology

The total thickness of permeable sediments beneath the Tri-Cities landfill is about 1,200 feet (1). The upper 140 to 180 feet consist of Recent alluvium and floodplain gravels. These materials are primarily unconsolidated coarse-grained sands, gravels, and boulders, which locally contain relatively large amounts of silt and some clays. The log of a nearby Union Rock Company production well indicates a well-developed clay zone at 30 feet. Nearby percolation test borings indicate heavily cemented silty sand or caliche at about 15 feet. Bedding in this unit is generally indistinct and chaotic, and is highly variable in thickness.

The lower sediments are older basin fill deposits consisting of unconsolidated sand, gravel, silt, and clay. The thickness of this unit is over 1,000 feet. Parts of the river terrace along the northern boundary of the landfill are capped with about 5 to 10 feet of silty loam. This material represents the relatively undisturbed A and B soil horizons.

Ground Water

Depth to the static ground water table at the landfill is about 230 feet (6). There is a strong possibility of perched water existing above this depth which is associated with fine-grained beds or lenses in the Recent alluvium or older basin fill deposits. Extensive local pumping has lowered the ground water table by about 200 feet over the last 50 years (5). Seasonal

and flood-related fluctuations in the ground water table elevation probably do not exceed about 25 feet.

The direction of regional ground water flow near the landfill is generally east-southeast, and is strongly influenced by high-volume pumpage from Salt River Project (SRP) wells located to the southeast and across the Salt River from the landfill (6).

Permeability in the Recent river channel and river bank deposits varies from about 3.53×10^{-3} to over 1.41×10^{-2} cm/sec (3). Percolation tests in the river terrace soils indicate a percolation rate of 0.34 cm/sec (2). Pump tests in some of the coarse-grained strata beneath the Recent alluvium indicate transmissivities from about 300,000 to over 500,000 gallons per day per foot (6). The rate of ground water flow at the water table beneath the Tri-Cities landfill is between 120 and 300 foot per year (6).

Most of the ground water pumped is used for the irrigation of croplands, although there is some limited use for drinking water. Complete records regarding water use and pumpage in nearby areas are available from state and federal water resources agencies.

In past years, the U.S. Geological Survey (USGS) has attempted to monitor some of the wells in the vicinity of the landfill. Results of selected USGS monitoring, as well as some results of more recent monitoring by others, are shown in Table 1 and discussed below. The predominant salt present in the ground water in the vicinity of the landfill was sodium chloride. Relatively low nitrate levels were present. Total dissolved solids (TDS) content ranged from about 550 to 690 mg/ℓ. The chemical quality

TABLE 1. CHEMICAL ANALYSES OF WELL WATER IN THE VICINITY OF THE TRI-CITIES LANDFILL*

	A-1-5 wells†					A-2-5 well
	2aaa2	2dbb	2cbb2	3ddc	4ddd2	22bcb
Date:	2/13/69	11/7/69	10/27/69	10/27/69	6/5/69	7/7/76
Constituent						
pH	7.9	8.1	8.3	8.4	7.8	7.4
Electrical Conductivity (micromhos/cm @ 25°C)	1,000	1,170	1,170	1,240	1,110	-
	mg/ℓ					
Total Dissolved Solids	553	636	659	691	612	1,160
Calcium	48	53	57	64	64	113
Magnesium	9	13	17	15	18	50
Sodium	154	173	176	182	148	210
Carbonate	0	0	0	0	0	0
Bicarbonate	201	250	232	227	190	217
Sulfate	29	29	33	37	25	135
Chloride	204	231	248	270	259	394
Nitrate	7	14	14	11	4	52
Fluoride	-	-	-	-	-	0.2
Hardness ($CaCO_3$)	159	167	210	223	234	489

* Data from U.S. Geological Survey computer printout for the East Basin of the Salt River Valley and from files of Indian Health Service, Phoenix, Arizona. Summarized by Schmidt (6).

† Well designation codes by USGS.

of this ground water was indicative of recharge from Salt River flood flows. Shallower ground water appeared to be of somewhat higher salinity. Results for well (A-2-5) 22bcb, located almost 2 miles northwest of the landfill, indicated that salt present in the ground water in that area was also predominantly sodium chloride. However, TDS content was higher and the nitrate content exceeded the drinking water limit of 45 mg/ℓ. The data suggest that recharge to ground water in this area may come largely from irrigation return flow.

In August 1979, water samples were collected by the USGS from numerous Salt River Project (SRP) wells in the vicinity of the landfill. The results of the 1979 sampling indicated that the pH's ranged from 7.3 to 7.4, and the electrical conductivities ranged from about 1,050 to 1,240 micromhos/cm at 25°C. Concentrations of fluoride typically ranged from 0.2 to 0.3 mg/ℓ, and dissolved oxygen levels were usually about 5 to 6 mg/ℓ. Iron, copper, manganese, zinc, chromium, cadmium, and selenium were generally present in concentrations below the detection limits. The only trace element that was present at noticeable levels was arsenic. Arsenic contents ranged from 0.008 to 0.014 mg/ℓ, and appeared to increase toward the landfill. Such contents are apparently common in some other parts of the valley, due to natural factors. These values are well below the EPA maximum contaminant level for drinking water of 0.05 mg/ℓ.

Water samples were collected by Schmidt in January 1980, from three nearby wells used to provide water for gravel processing

(6). Results of chemical analyses are presented in Table 2. In general, these wells are shallower than the SRP wells to the south and east. However, the chemical quality of water from the gravel processing wells appeared to be similar to that from the deeper wells. Salinity and nitrate contents were slightly higher in the shallower ground water. Concentrations of trace elements, including arsenic, were generally below 0.01 mg/ℓ. Schmidt concludes that there is no indication of leachate contamination of ground water in the vicinity of the landfill, based on data from existing wells. However, it is possible that these wells are not located downgradient from the landfill, and thus had not intercepted ~~possible~~ that may be leachate originating in the landfill.

Flood and Erosion Factors

Disposal operations are situated adjacent to the main Salt River channel, and are within the active floodplain of the river. Low areas in the landfill have been inundated and partially washed out during several recent floods in the Salt River.

The Salt River is normally dry in the Phoenix area. However, a combination of factors, including heavy precipitation and dam releases, has resulted in very high stream discharges and gage levels in the river. This has occurred several times within the past few years. During the winter of 1978-1979, flood waters entered an old river channel at the upstream end of the landfill, resulting in the washout of a large volume of deposited wastes into the Salt River. A similar inundation occurred during the winter of 1979-1980, although little washout occurred in the

TABLE 2. CHEMICAL ANALYSES OF WATER FROM INDUSTRIAL WELLS NEAR TRI-CITIES LANDFILL*

	A-1-5 Wells		A-2-5 Well
	3 acc	4 dad	34 ccb
Date:	1/11/80	1/17/80	1/17/80
Constituent			
pH	7.4	7.6	7.7
Electrical Conductivity (micromhos/cm @ 25°C)	1,050	940	1,100
		mg/ℓ	
Calcium	62	45	51
Magnesium	18	17	20
Sodium	190	188	203
Potassium	4	4	4
Carbonate	0	0	0
Bicarbonate	243	262	204
Sulfate	60	63	64
Chloride	257	205	284
Nitrate	22	17	18
Fluoride	0.26	0.29	0.33
Iron	<0.05	<0.05	<0.05
Manganese	<0.01	<0.01	<0.01
Arsenic	<0.01	<0.01	<0.01
Zinc	<0.02	0.03	0.03
Cadmium	0.02	<0.01	0.01
Chromium	<0.01	<0.01	<0.01
Lead	<0.01	<0.01	<0.01
Boron	0.13	0.02	0.02

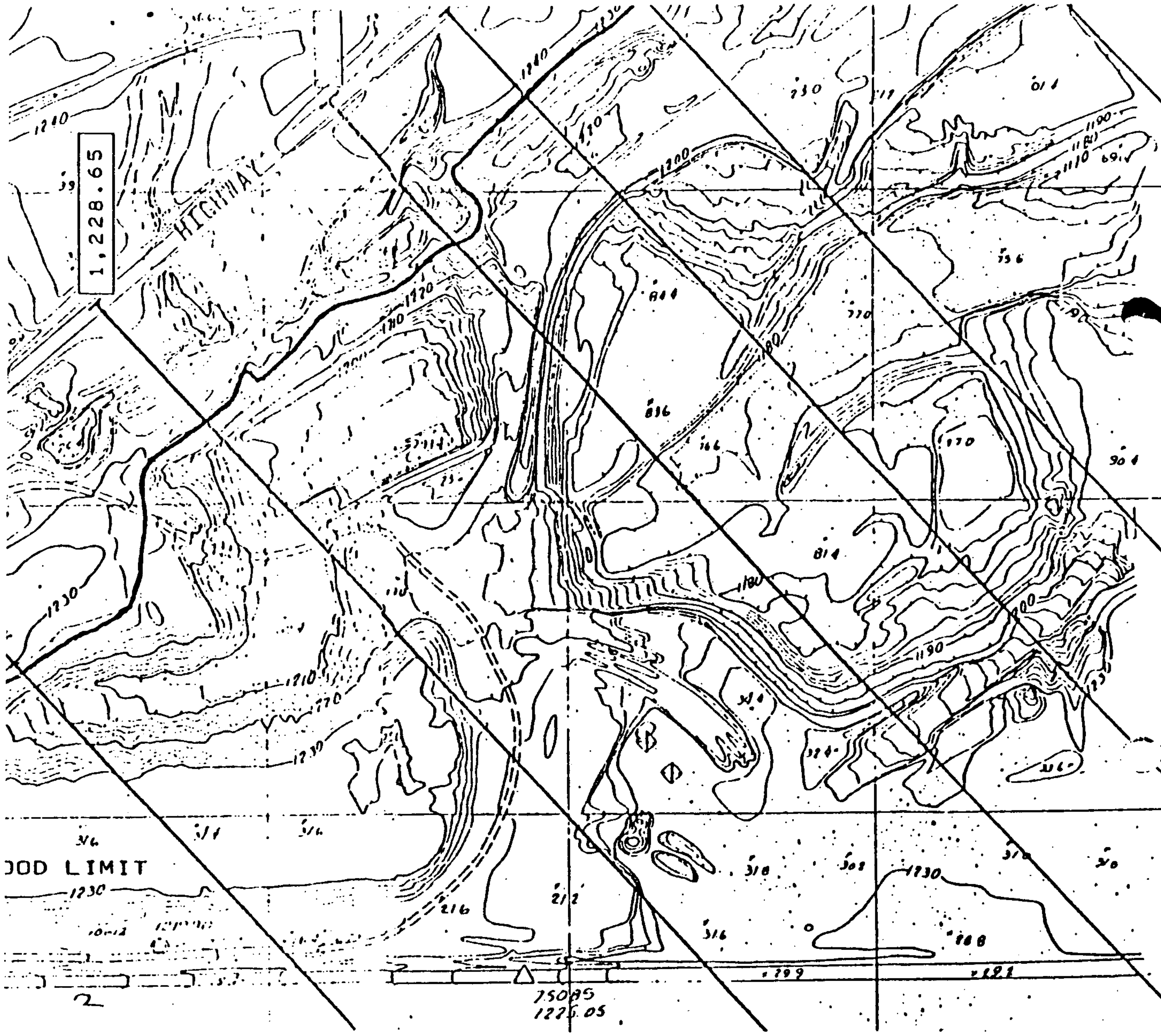
* Data from Schmidt's report (6).

North unit, because of corrective measures taken in 1979. Some refuse was washed out of the South unit, however. Stream discharge in December 1978 was about 115,000 cubic feet per second (cfs). Peak stream discharge during the 1979-1980 floods was about 170,000 cfs, equivalent to a projected 500-year flood flow.* Figure 2 indicates the approximate 100-year flood limits and gage levels (river elevations) in a part of the Tri-Cities landfill.

One large berm (A) and three small berms (B, C, and D) were constructed after the washout in late 1979 near the upstream end of the landfill to confine river water within the main stream channel and to prevent flooding of the landfill. Figure 3 is an aerial photograph showing flooding conditions in December 1978, and the approximate locations of the flood control berms constructed in late 1979. The berms are composed of solid waste, which have been mixed and covered with sand, gravel, and boulders derived from local river deposits. Berm A is about 50 feet wide at the base and about 200 yards long. The fill slope gradient averages about 34^{0}, or 1.5:1.

In March 1980, a field examination was made of the Tri-Cities landfill to assess the effects of recent flooding along the Salt River. At this time, Berm A was heavily eroded, and the solid waste core was exposed, resulting in the release of some wastes into the Salt River. Flood water had entered the landfill through an area of low elevation below the downstream end of Berm A, inundating a large area of waste fill, including areas that reportedly had been used for the disposal of liquid industrial waste.

* Personal communication with Union Rock Company, February 1980.



gage levels - part of the landfill.

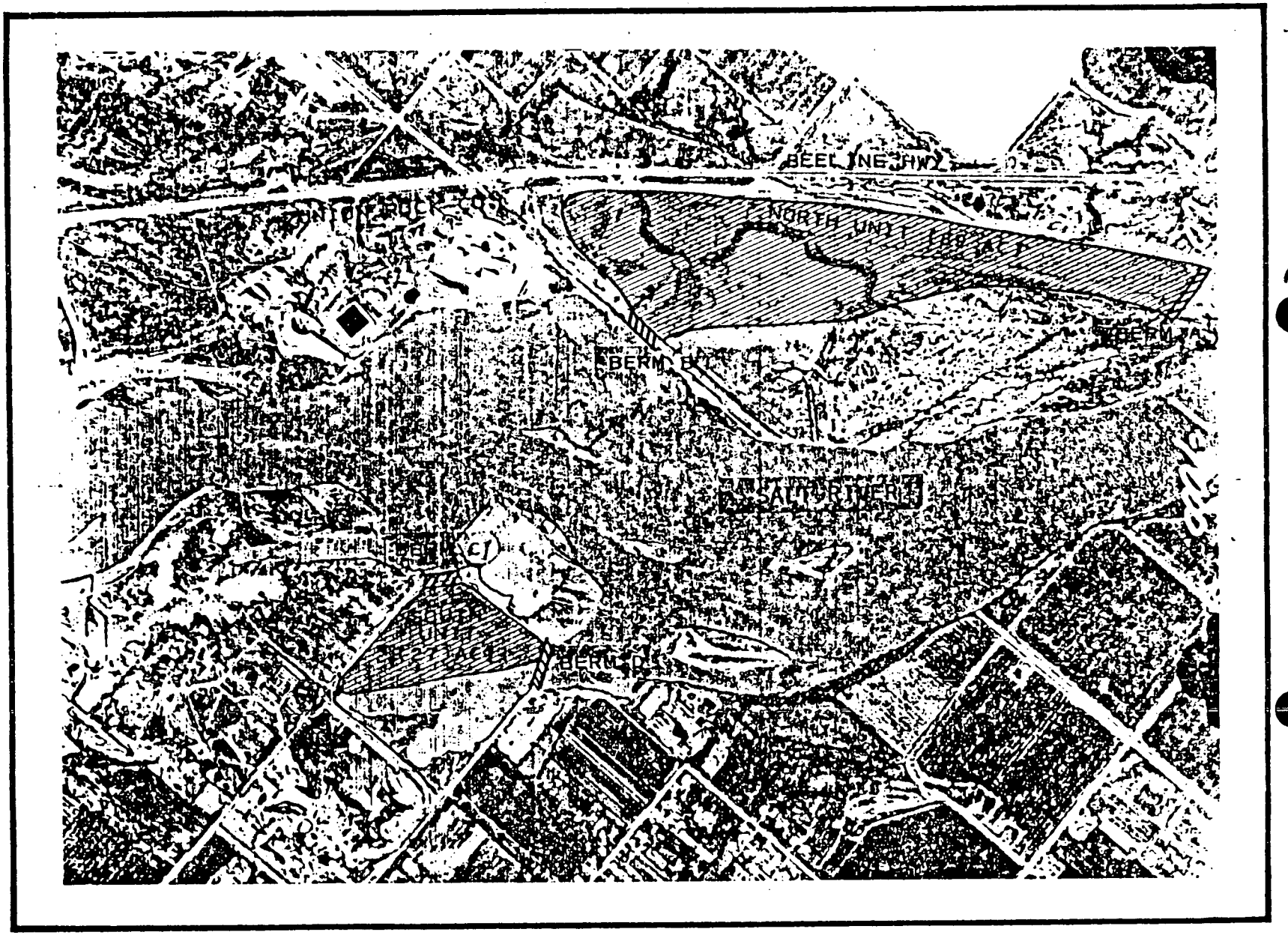


Figure 3. Flooding conditions in December 1978; Tri-Cities landfill.

Local incident precipitation and runoff currently pose no significant threat of erosion to the landfill facilities. Drainage in the landfill area is generally internal, which contributes to ponding, but has not resulted in channeling or other erosional features. No drainage structures have been constructed on the site apart from an emergency deep channel drain excavated in March 1980 to dewater a portion of flooded landfill.

During a site inspection in February 1980, it was observed that surface runoff was contributing to minor ponding in most areas of the landfill. Deep ponding had developed in several areas in cover soil overlying deposited wastes. A subsequent examination in March 1980 revealed that deep impounded flood waters were seeping into several already-filled and active disposal areas at a rate of approximately one foot per day. Although the surface of the landfill is dry during most of the year, the potential for leachate generation and migration under these ponding conditions does exist.

LANDFILL FACILITY

History

An area approximately 1 mile east of the present Tri-Cities landfill was leased to the city of Scottsdale for its landfill operation, which lasted from 1968 to 1972. In 1972, the Indian community decided to run its own landfill to serve the three cities of Mesa, Scottsdale, and Tempe. With technical assistance from the federal government, the Tri-Cities landfill was sited and a preliminary plan prepared. The initial site plan is not

available from either the EPA, the Indian Health Service, or the Maricopa Association of Governments, however.

The Tri-Cities landfill started operation in 1972. No major problems had been encountered until the floods that occurred in December 1978. The Indian community as well as the ADOHS were concerned that present and potential future flooding could cause adverse environmental impacts, resulting from water movement through deposited refuse and washout of refuse from the landfill. Also, in 1979, EPA promulgated its criteria and associated guidelines for sanitary landfill facilities which must be met by all disposal sites in the United States.

Boundaries

The Tri-Cities landfill, for practical purposes, consists of two main waste disposal areas: the North and South landfill units, which are separated by the Salt River channel. The boundaries for these two landfills have not been precisely defined. With the assistance of the Site Manager, the approximate boundaries were determined and are indicated in Figure 4.

The North landfill unit covers about 89 acres, of which 54 acres have been or are being filled. The South landfill unit covers about 27 acres, only 5.6 acres of which have been filled. When the Salt River is dry, disposal trucks and landfill equipment can cross the channel to either landfill unit. When the river is flowing, however, access across the channel is curtailed. At these times, the South landfill unit receives MSW primarily from the city of Mesa.

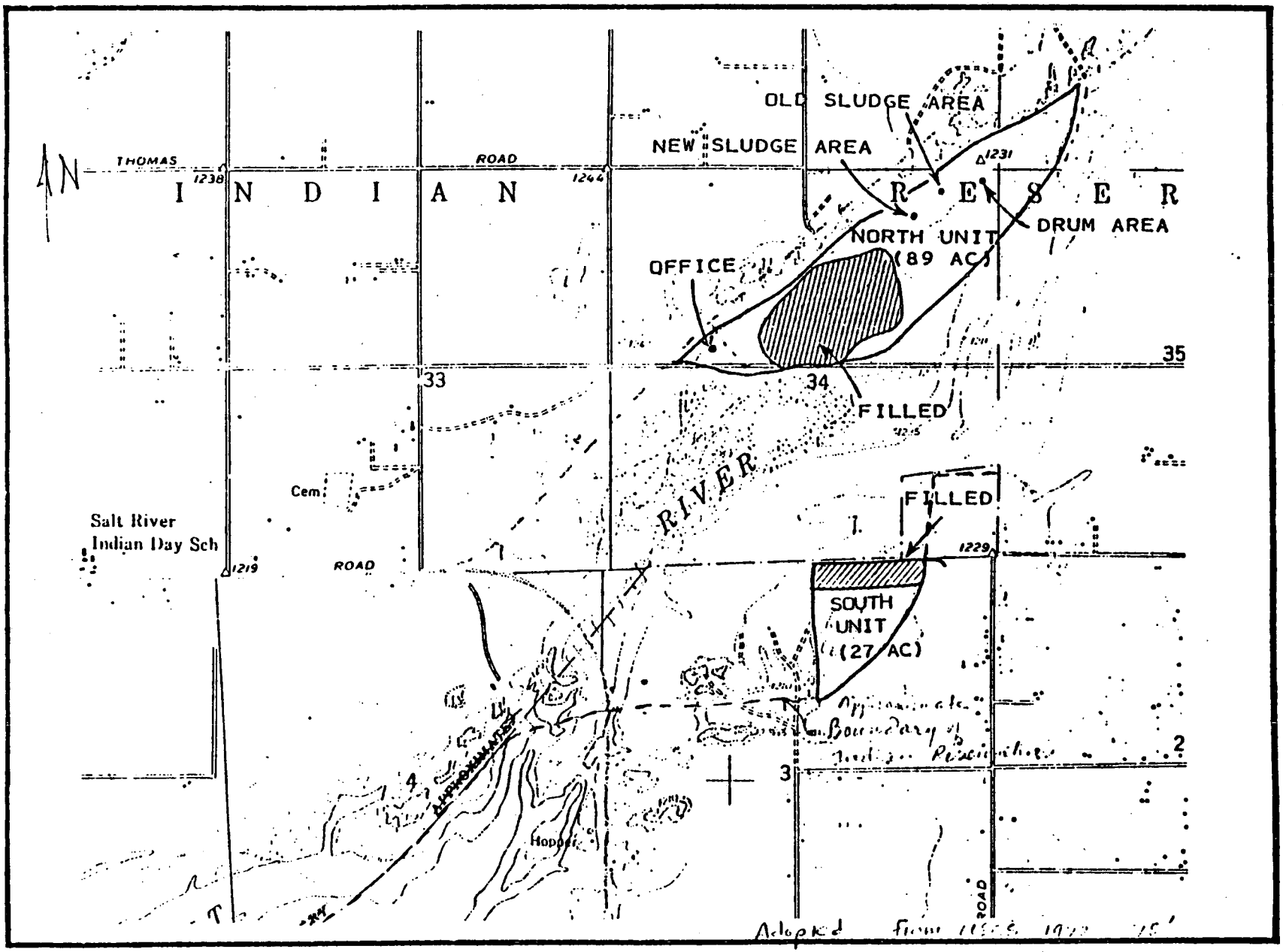


Figure 4. Approximate boundaries of Tri-Cities landfill.

Quantities of Wastes

The Tri-Cities landfill has received about 25,000 tons of municipal solid waste per month for the last 3 years (Figure 5). The waste is delivered primarily from three nearby cities: Mesa, Tempe, and Scottsdale. Smaller amounts of additional MSW are brought in from the surrounding Indian community. In addition, several local construction companies dispose a significant volume of construction debris at the facility.

Liquid wastes are delivered to the site by a number of cesspool and sanitary service companies serving the greater Phoenix area, including the Indian community. Volumes of liquid wastes have fluctuated monthly, but have averaged about 2,000 loads per year since 1976 (Table 3). Each load of liquid wastes weighs from a few tons to as much as 10 tons.

Effective February 1, 1980, the gate fees for municipal solid waste and liquid wastes are posted at $3.05 and $2.75 per ton, respectively. There are approximately 250 individuals and companies on the Tri-Cities landfill customer list.

Using the former rates of $2.75 per ton for municipal solid waste and $2.75 per load for liquid wastes, the annual income for the landfill was estimated for the last 3 years (Table 4). Since the gate fee for liquid wastes is presently based on tonnage rather than load, annual income from this waste source will be increased at least five to eight fold over previous years.

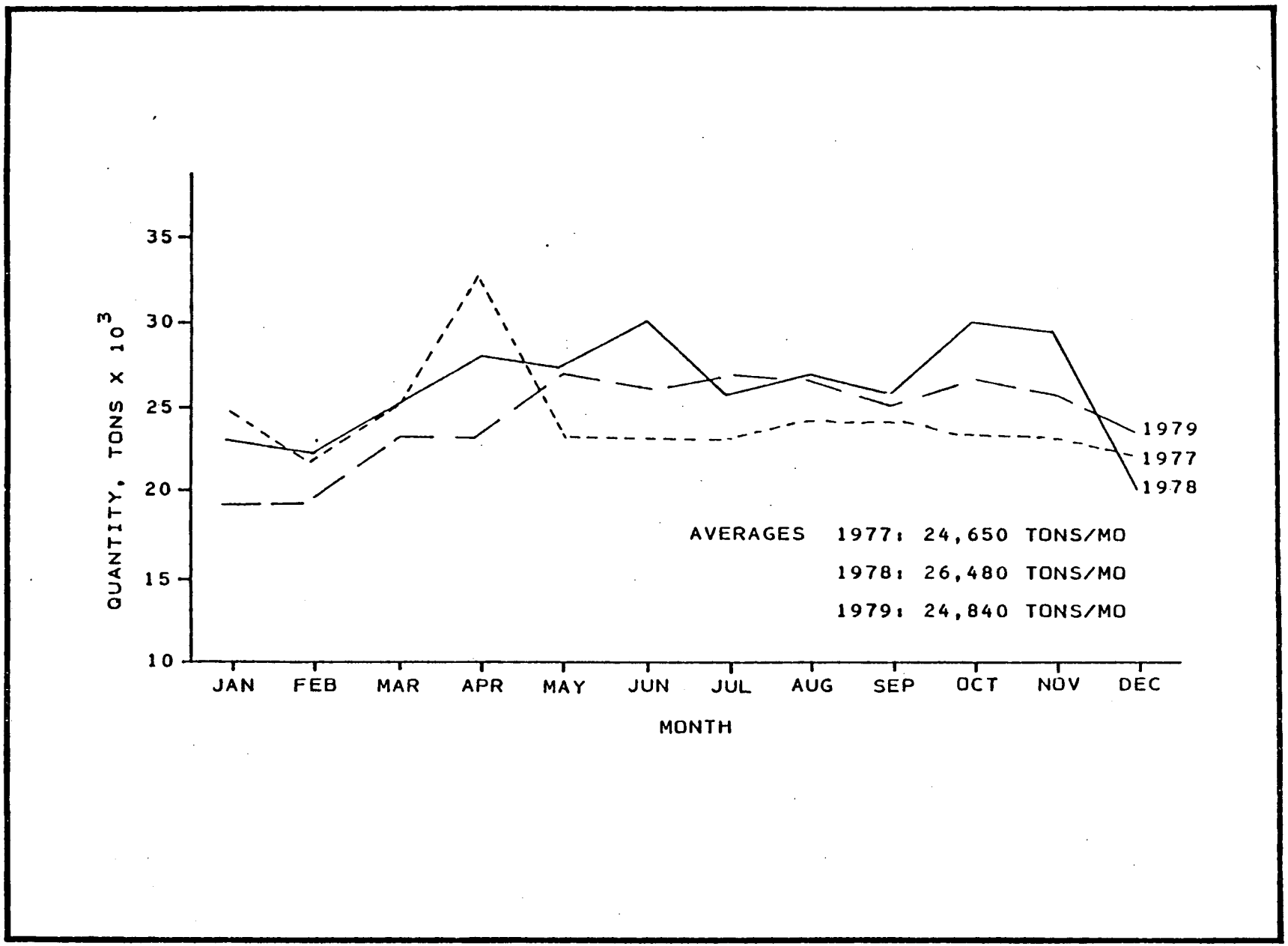


Figure 5. Quantities of solid waste received, 1977-1979.

TABLE 3. ESTIMATED QUANTITIES OF LIQUID WASTE DISPOSED

Month	Year				Average
	1976	1977	1978	1979	
	Number of Loads				
January	171	203	200	190	191
February	161	217	202	142	181
March	183	381	194	161	230
April	147	243	222	183	199
May	136	192	166	193	172
June	124	123	99	146	123
July	142	111	129	164	137
August	129	134	122	208	148
September	151	146	138	175	153
October	175	156	161	122	154
November	186	149	195	124	164
December	243	171	135	114	166
Total	1,948	2,226	1,963	1,923	

TABLE 4. ESTIMATED LANDFILL INCOME*

Source	Year 1977	1978	1979
Municipal Solid Waste	$813,500	$873,600	$819,600
Liquid Wastes	6,100	5,400	5,300
Total	$819,600	$879,000	$824,900

* Based on gate charge of $2.75 per ton for MSW and per load for liquid wastes.

Operating Procedures

In general, filling operations are conducted in exhausted sand and gravel quarries left by cement aggregate production. Municipal solid waste is spread upon delivery, covered, and compacted daily with surface coarse-grained soil. Course-grained soil is also used for final cover. The filling operation was considered to be satisfactory at the time of site inspections by the TAP contractor. The landfill is typically operated 6 days per week, from 7:30 a.m. to 5:30 p.m. Except for floods that occurred in the winters of 1978-1979 and 1979-1980, there have been no major operating or environmental problems. No public opposition to the site has been recorded. Presently, there is no detailed engineering design, nor plans for operation, closure, and ultimate land use for this site.

Equipment and Personnel

There are 13 employees at the Tri-Cities landfill. The site is managed by a Site Supervisor who reports to the Public Works Director of the community.

Equipment includes two Caterpillar D-8 bulldozers, two G27 pull scrapers, one steel-wheeled compactor, one road grader, and one 8,000-gallon water truck. All equipment has been acquired through lease-purchase agreements. Equipment maintenance work is performed by vendor mechanics, not Tri-Cities personnel. Site facilities include a 60-foot scale and scale house, a shop and storage building, and surface storage tanks for diesel fuel used by heavy equipment.

Life Expectancy

The Reservation Public Works Director has indicated that the remaining life of the Tri-Cities landfill would be at least 20 years, assuming that the landfill boundary could be extended by another 20 miles toward McDowell Mountain. Since only about 56 acres or 48 percent of the land presently within the filling area (as shown on Figure 4) is available for landfilling, and the new pits are shallower than the old ones, the remaining life of the Tri-Cities landfill within its present boundaries is estimated to be around 6 years. This estimation is based on the available filling volume and the assumption that the volume of the wastes to be received will remain relatively constant over the next 6 years.

The Indian community has planned to expand the site with a resource recovery project which includes shredding of MSW and steel recovery. However, it is estimated that only about 5 percent of the solid waste will be recovered using the proposed shredding system. Since the volume of MSW to be reduced by this action is minimal, the resource recovery project would not significantly increase the site's life.

HAZARDOUS WASTE DISPOSAL

Potential Sources

The Tri-Cities landfill is designated as a sanitary landfill. Hence, the Site Manager and Director ~~of~~ Public Works of the Pima-Maricopa Indian community indicate that the site accepts only MSW and septic tank pumpings. Records show no hazardous or

potentially hazardous waste deliveries. As a result, it is impossible to ~~precisely~~ identify from existing records the extent to which hazardous waste may have been delivered to the Tri-Cities, if such waste has been delivered at all.

Unauthorized deliveries of hazardous waste can occur in several ways (including: as experienced at other landfills):

- Municipal solid waste loads can contain hazardous waste to a certain degree.
- Septic tank pumpings may contain other liquid wastes of unknown source and composition.
- Unauthorized or undetected entry of haulers with hazardous wastes.

Site customers are told that the landfill accepts no hazardous waste. If this prohibition is violated, offending customers will no longer be allowed to use the landfill. However, some of the septic tank pumpings may contain hazardous liquid wastes (oily waste, pesticide rinsate, acids, etc.), because their contents are not subject to inspection and/or chemical analysis. Of the 16 liquid waste (cesspool) haulers contacted during this project, ~~only~~ one indicated that it had dumped some liquid waste at the landfill that may be considered hazardous. However, the data on the volume, source, and type of the liquid waste were not made available.

Several major industrial waste generators in the general vicinity were also contacted regarding their past and present hazardous waste management practices. These included Motorola, Union

Carbide, Western Electric, Ashland Chemical, Honeywell, and Shell Oil. These waste generators stated that either no hazardous waste was generated or the waste did not go to the Tri-Cities landfill. Information from ~~In contrast,~~ the IHS indicates ~~stated in a memo~~ that unknown quantities of hazardous waste have ~~had~~ been disposed of in the Tri-Cities landfill. The Maricopa County Transportation Department and ADOHS do not have in their files disposal records of these or any other producers of possibly hazardous waste.

During a second site visit in February 1980, about 20 55-gallon drums were observed at the northeast portion of the Tri-Cities landfill North unit. Many of the drums had burst and were leaking. (Deposits of previously applied liquid waste were ~~vividly~~ visible on the soil surface at this location.)

The labels on the drums read:

- Colloidal silica.
- Fire extinguisher foam liquid concentrate.
- Chlorothene VG (inhibited 1,1,1-TCE), Dow Chemical.
- Tizox 1300 polishing compound, Ferro Chemical.
- Propylene glycol, McKesson Chemical.
- Vacuum pump oil, VWR Scientific.
- Hydraulic fluid petro base (MIL-H-5606C and Amendment 1), Bray Oil Company.
- Gear oil.
- Concrete curing liquid, Hunt Process.

There is no indication that the drum contents correspond to label descriptions. The Site Manager indicated that these

were empty drums from Motorola. This company reported delivers about 20 drums per month for disposal. If the drums are in good condition, they are sometimes used as trash cans in the administrative buildings of the community. Otherwise, they are crushed with heavy equipment and buried with the refuse.

Visual Inspections ~~indicate~~ suggest that ~~at least~~ some of the drums may have ~~did~~ contained residual chemicals (per the label), oily waste, or other non-MSW wastes. Some of these wastes may be classified as hazardous. It is not apparent how many drums containing leftover or other chemicals have been received and buried in the landfill.

Liquid Waste Disposal Procedure

According to the Site Manager, some ponded liquid waste has been removed from the original disposal areas and spread onto newly deposited MSW. Liquid waste is currently pumped and spread over the in-place MSW. There is neither a special procedure nor a special area set aside for liquid waste disposal.

Waste Sampling

With the assistance ~~and knowledge~~ of the Site Manager, areas where liquid waste was believed to have been buried in the past were marked on a site map (Figure 4). Two surface, uncontaminated soil and eight waste samples from randomly selected locations of the North unit were taken. The deepest samples were taken at about 2 feet from the surface. No samples were taken from the South unit of the landfill. The waste samples ranged from brownish to black in color; some apparently contained oil and had no foul odor.

A sharp reduction in liquid waste deliveries has occured since February, 1985 when the disposal fee for [illegible] was raised.

Sample identification is given in Table 5. Each sample was prepared and analyzed for selected constituents using EPA-approved procedures. Due to the limited time and budget available for this project, only a limited chemical identification of the waste samples was possible. Table 6 presents the analytical results.

TABLE 5. IDENTIFICATION OF SOIL AND WASTE SAMPLES

Sample Number	Identification*
S-1	Surface, uncontaminated soil from old sludge area.
S-2	Surface, uncontaminated soil from spots near drum area.
W-1	New sludge (<1.5 yr old).
W-2	New sludge (<1.5 yr old).
W-3	Sludge from drum area.
W-4	Sludge from drum area.
W-5	Old sludge (>2.0 yr old).
W-6	Old sludge (>2.0 yr old).
W-7	Sludge from spots near drum area (0-1 ft deep).
W-8	Sludge from spots near drum area (1-2 ft deep).

* See Figure 4 for exact locations. Age of sludge was estimated by Site Manager.

TABLE 6. ANALYTICAL RESULTS OF SOIL AND WASTE SAMPLES, TRI-CITIES LANDFILL (February 14, 1980)

Sample*	pH	Oil and Grease	Organic C	Metal						Pesticide		
				Cu	Zn	Ni	Cd	Pb	Cr	Diazinon	Diuron	Trifluralin
		%		mg/kg†								
S-1	7.4	0.002	0.71	35	15.4	22	0.6	107	19	--	--	--
S-2	6.9	0.002	0.60	33	6.2	13	0.9	133	22	--	--	--
W-1	6.3	5.78	17.79	700	240	84	13	121	63	0.04	ND#	ND
W-2	6.4	6.67	22.18	914	405	136	14.9	1,714	67	ND	0.005	<0.001
W-3	7.3	0.002	0.87	44	4.7	96	3.0	101	32	0.05	0.006	ND
W-4	8.7	0.05	1.42	216	21	126	6.6	152	67	ND	0.01	ND
W-5	6.4	4.40	19.49	734	149	152	9.6	995	51	ND	0.01	ND
W-6	6.5	3.02	4.01	34	38	208	4.1	180	29	ND	0.006	0.005
W-7	7.5	1.09	2.85	37	12	114	3.9	126	66	0.04	0.04	0.002
W-8	7.3	1.43	3.18	91	20	41	1.8	116	11	ND	0.1	0.01

* See Table 5 for sample identification.

† On oven-dry weight basis.

Nondetectable.

SECTION 3

ASSESSMENT OF LANDFILL

The Tri-Cities landfill was assessed in regard to compliance with federal criteria for sanitary landfills and hazardous waste disposal sites. The assessment was based on four approaches:

- A thorough study of the Guidance Manual for the Classification of Solid Waste Disposal Facilities (7) and related federal regulations.
- A review of all available documents concerning the Tri-Cities landfill and surrounding areas.
- Interviews with representatives of the Indian community and responsible landfill personnel and Indian Health Service and Department of Public Health Sanitation officials.
- Two field examinations at the site, one following a major flood in the Salt River.

LANDFILL FACILITY

RCRA Criteria for the Classification of Solid Waste Disposal Facilities

New federal criteria regarding the operation and classification of solid waste landfills are reflected in the Guidance Manual (7). The manual is organized into eight chapters, each dealing with a particular set of problems that may be associated with solid waste disposal facilities. Each chapter provides a description

of applicable regulations and potential problems, as well as technical guidance for determining whether an individual facility conforms or does not conform to each criterion.

Pertinent parts of the Guidance Manual criteria have been assembled into a field checklist form. The checklist is a compilation of the various chapters and sections of the Guidance Manual.

Status of Compliance

During and subsequent to site inspection and interviews, the checklist form was carefully completed (Appendix A). The Tri-Cities site conditions and its status of compliance with the criteria were then determined.

The Tri-Cities landfill has been determined to have met the majority of the criteria, except for the following parts:

- Chapter 2(a), Section 2*: Methane gas that may be generated in the fill is not prevented from migrating beyond the property boundary and accumulating in facility structures.

  Due to site location in sand and gravel pits and the proximity of facility structures, there may be a high potential for methane hazard (Section 3). It is likely that methane is being generated; however, no testing for methane presence was conducted as part of this project.
- Chapter 2(d), Section 1: Access of unauthorized persons into the facility is not adequately controlled.

* Chapter and Section references relate to Reference 7.

Existing natural and artificial controls (topography, fencing, etc.) are not sufficient to prevent unauthorized entry by vandals, or persons who may deliver hazardous wastes after hours.

- Chapter 3, Section 4: The facility apparently violates requirements established pursuant to Section 404 of the Clean Water Act.

  Construction of the flood control berm near the upstream end of the landfill is considered to be a discharge of dredge or fill materials to waters of the United States, for which a Section 404 permit is required.

- Chapter 8, Section 3: Operation of the facility has resulted in, and has the potential for recurrence of, washout of solid waste so as to pose a hazard to land or water resources.

  Noncompliance with this section is based on the established history of washouts at the landfill by 100-year floods. This violation applies to the washout of covered and uncovered waste materials in the main or central part of the landfill, as well as to erosion of wastes used in the construction of the flood control berm.

- Chapter 8, Section 4: The facility is not protected from washout by the base flood (100-year flood) and poses a hazard to land or water resources.

  Noncompliance with this section is based on the same factors cited for noncompliance with Chapter 8, Section 3 above.

In addition to the above-cited violations, there may be other instances of noncompliance at the landfill. The determination of additional violations is dependent on results of methane gas and ground water monitoring, as prescribed by the Guidance Manual.

The requirement for methane gas monitoring is indicated in Chapter 2(a), Section 4. The landfill will be in compliance with this section if the concentrations of methane, as determined by monitoring, do not exceed 25 percent of the Lower Explosive Limit (LEL) in facility structures or the LEL at the property boundary.

The requirement for ground water monitoring is indicated in Chapter 4, Section 3, relating to the contamination of underground drinking water sources by the facility beyond the solid waste boundary. The landfill will be in compliance with this section if the applicable Maximum Contaminant Levels (MCL's), as determined by monitoring, are not exceeded. Monitoring should be conducted according to guidance provided in the Procedures Manual for Ground Water Monitoring at Solid Waste Disposal Facilities (9).

The degree and extent of possible ground water contamination by leachate migration is best determined from subsurface water samples collected in the anticipated direction of ground water and leachate flow. It is doubtful that existing water wells near the Tri-Cities landfill are suitable for use as monitoring wells for the following reasons:

- The production well at Union Rock Company is not located in the direction of ground water flow from the landfill, ~~and is screened in the~~ older basin fill deposits well ~~below the depth at which possible leachate would be~~ expected to occur. Pumping at this well is intermittent,